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title: Puvis de Chavannes’s \*Philosophy\* Mural

subtitle: Tactics for the Reversal of a Beva 371b Marouflage Lining from an Aluminum Honeycomb Panel

contributor:

* first\_name: Ian

last\_name: Hodkinson

title: Emeritus Professor of Art Conservation

affiliation: Queen’s University, Kingston, Canada

* first\_name: Gianfranco

last\_name: Pocobene

title: Principal and Chief Paintings Conservator

affiliation: Gianfranco Pocobene Studio, Malden, Massachussets

* first\_name: Corrine

last\_name: Long

title: Associate Paintings Conservator

affiliation: Gianfranco Pocobene Studio

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abstract: During the 2016 conservation of Puvis de Chavannes’s *Philosophy* mural, one of nine canvases commissioned for the Boston Public Library and marouflaged to the wall in 1896, it was discovered that water infiltration had resulted in detachment of up to 80% of the canvas from the wall. After successful stabilization, facing, and removal from the wall, the painting was prepared with a fabric interleaf for marouflage onto a custom-built aluminum honeycomb panel for reinstallation into its niche. The failure of the panel, however, necessitated complete reversal of the marouflage and replacement of the panel constructed with a stronger epoxy adhesive. In this paper, the procedure to safely remove the faced, but stiff and brittle mural from the panel is described. The difficulty of carrying out the reversal led to the modification of the Beva 371 formula for the reattachment of the mural in order to facilitate future reversal, should the need arise.

short\_title: Puvis de Chavannes’s \*Philosophy\* Mural

# <A-head> Introduction

Since its introduction by Gustav A. Berger in the early 1970s, Beva 371 has been widely used as an adhesive for the lining of easel paintings and the mounting of murals onto rigid supports ({{Berger and Russell 2000}}). As it is a relatively recent introduction to the field of paintings conservation, the necessity of reversing a Beva 371 lining is an uncommon occurrence. While the reversal of paintings lined onto canvas supports with Beva 371 can be somewhat demanding, the removal of a large-scale mural painting adhered to a rigid support with Beva 371 presents the conservator with an extraordinary set of challenges.

With the application of heat and solvents, canvas lining fabrics can be peeled away from the reverse of an easel painting, but rigid support panels cannot, therefore different strategies must be devised. The strong adhesive properties of Beva 371 and its rather high activation temperature further complicate the procedure. The adhesive used for the marouflage procedure described in this essay is Beva 371b, which replaced the original Berger formulation in 2010. Laropal K80 (BASF), a tackifier in the original adhesive, was discontinued in 2008. In the reformulated Beva 371b, “an aldehyde ketone resin” was substituted for it ({{Conservator’s Products Company 2010}}).

In 2016, Puvis de Chavannes’s *Philosophy* mural ([**fig. 12.1**](file:///Users/RBarth/Desktop/Finalized%20files-Conserving-Canvas--72122-to%20prep%20for%20TR/12-Hodkinson%20Pocobene/fig-12-1)), one of nine monumental murals the artist painted for the Grand Staircase of the Boston Public Library in 1895–96, underwent a major conservation campaign. Delamination of the 435.6 x 217.8 cm mural canvas and failure of the underlying plaster necessitated emergency removal of the mural from the wall, mounting of the canvas onto a rigid support panel, and reinstallation in its niche. The project was presented by the authors at the 2017 AIC Conference General Session in Chicago; however, time constraints did not permit a thorough discussion of the unexpected failure of the aluminum honeycomb panel support during the lining procedure. This necessitated the reversal of the marouflage lining and replacement of the panel with one of better design and materials.

In addition to describing the procedure implemented to reverse the marouflage and the successful remounting of the mural canvas, the logistical complications of undertaking such a procedure are presented in this paper. The difficulty of carrying out the reversal led to a reassessment of using Beva 371b as recommended by the manufacturers. Tests conducted on mock-up panels led to a modification of the adhesive to reduce its strength, tack, and melting point—and by extension increased its reversibility—while still retaining its essential properties as a suitable marouflage lining adhesive.

# <A-head> Project Overview

The murals in the grand staircase of the Boston Public Library were painted on canvas by Puvis de Chavannes in Paris. The artist achieved his famed fresco-like surfaces by using various innovative techniques, including painting on a coarse, plain-weave linen canvas; priming the canvas with animal glue size; applying an extremely thin, absorbent chalk ground bound in animal glue; draining his oils by placing them on blotting paper; thinning his paints with turpentine; adding extensive amounts of white lead to his color mixtures; and leaving the mural surfaces unvarnished ({{Hensick, Olivier, and Pocobene 1997}}).

Upon completion, the reverse of each mural was primed with red lead in oil, rolled, shipped to Boston, and mounted to the plaster walls using the marouflage technique ([**fig. 12.2**](file:///Users/RBarth/Desktop/Finalized%20files-Conserving-Canvas--72122-to%20prep%20for%20TR/12-Hodkinson%20Pocobene/fig-12-2)). The original method of attachment was to adhere the canvas to the wall with a paste of lead white in linseed oil applied to both the wall and the back of the canvas painting, which was then pressed onto the wall with rollers. While the adhesive was curing, the canvas was secured around the perimeter by a series of metal tacks.

In late 2014, a large canvas bulge and undulations were discovered in the upper portions of the mural. Salt efflorescence observed on the surrounding marble confirmed moisture infiltration. None of this was a surprise, as the mural has had a history of moisture problems, as noted in 1993 when the Puvis de Chavannes murals were last conserved by the Straus Center for Conservation, Harvard Art Museums ({{Hensick, Olivier, and Pocobene 1997}}). Mapping of the mural surface revealed that nearly 80% of the canvas had separated from the plaster substrate, yet along the left and bottom edges, the canvas was still very firmly attached to the wall.

Furthermore, a large area of the plaster substrate had also detached from the wall structure and was exerting considerable outward pressure on the canvas, raising fears of catastrophic failure. The plaster substrate consisted of expanded metal lath coated with three plaster layers: scratch coat, brown coat, and finishing coat, all composed of lime plaster of approximately 2.2 cm total thickness. Inserting a microspatula between the canvas and plaster instantly shattered the paint film, indicating that the canvas and ground were extremely brittle. This also confirmed that the adhered portions of canvas could not be separated from the plaster without incurring considerable damage to the paint surface.

Given the brittleness of the mural layers, the stiff white lead marouflage adhesive, and the strong bond where the canvas remained adhered to the wall, detaching and rolling the mural canvas off the plaster was clearly impossible. To prevent damage, the only viable approach was to totally detach the mural canvas along with the attached plaster portions from the metal lath substrate while keeping it as much in plane as possible.

The basic concept of detaching the mural is straightforward: support the mural at the top while detaching it starting at the bottom. Though the approach is simple in concept, numerous challenges became immediately evident.

* As the mural was in a recess, the edges of the canvas could not be accessed.
* Limited access could be provided at the bottom, but only if the marble fascia below the mural was removed.
* It was unclear how to support the painting and failed plaster in the arch area while separating the mural from the wall to reveal the bottom edge.
* It would be necessary to coordinate application of facings and removal of the oak trim within the arch without collapse of the structure.
* At some point, the plaster would need to be severed to release the mural where it was still firmly attached.
* The best type of protective facing materials and adhesives to use to protect the painting during the trauma of removal and subsequent structural work had to be determined.

As rolling the mural off the wall was deemed to be too dangerous, a system had to be devised to keep the mural in plane as much as possible during detachment. After considerable testing and experimentation with scaled mock-ups, the process of detaching the mural from the wall was carried out. The mural was faced first with Kozo (Usu Mino) paper sheets (after thorough testing for reversibility on mock-ups) and a specially formulated emulsion adhesive consisting of the following:

20 parts Golden MSA-UVLS Matte Varnish (chosen for its relatively low toxicity, ease of removal, and detectability under UV light)

* 2 parts odorless mineral spirits
* 1 part distilled water

The adhesive was emulsified with water to wet the paper fibers so they could conform to the paint topography.

Belgian linen was chosen as the primary facing material for the mural. Strips measuring 1 x 4 feet were adhered using the same MSA-UVLS mixture used for the Kozo paper facing, strengthened by incorporating 20% Beva Gel. Where maximum stress was anticipated, such as the perimeter of the mural and the vertical joins of the linen facing, additional linen reinforcement strips were adhered with Beva 371b.

At this point, the most nerve-wracking component of the project could begin: the detachment of the mural from the wall. The mural was secured at the top with padded plywood forms and pressure clamps. Working from the bottom up, the mural portions still firmly attached to the plaster wall were detached by severing the plaster from the metal lath substrate using modified slate rippers and vibration applied with a rubber mallet through a padded plywood sheet.

As the mural became detached, linen facing flaps extending beyond the perimeter of the mural were wrapped and stapled to the lightweight support panels. As the work proceeded up the surface, more panels were affixed and locked together to keep the mural in plane. Finally, with much of the mural supported by the locked panel supports, the section within the arch was detached. Once the entire mural was fully detached, full-length vertical and horizontal wood stiffeners were attached to the panel support system ([**fig. 12.3**](file:///Users/RBarth/Desktop/Finalized%20files-Conserving-Canvas--72122-to%20prep%20for%20TR/12-Hodkinson%20Pocobene/fig-12-3)). A block-and-tackle system was connected from the staging to the rigid frame support on the mural to guide it out. The supported mural was then lowered, slowly coming to rest face down on the staging deck. The mural was then removed from the deck and transported to a specially modified treatment space within the Boston Public Library.

The history of water leaks behind the mural precluded the possibility of remounting the mural onto a new plaster wall, so the decision was made to marouflage the mural onto a rigid panel support that could be easily installed—and deinstalled in the future, if necessary. The plaster remnants on the verso were removed using first a reciprocating multitool to cut through the bulk of the plaster, followed by mechanical removal of the harder 3 mm–finish coat using chisels. The lead-white adhesive was well bound, uniform, and strongly adhered to the reverse of the mural canvas, leaving none of the canvas exposed, thus it was left undisturbed. In preparation for lining, the reverse of the mural canvas was sealed with one coat of warm Beva 371b diluted with low-aromatic mineral spirits following the manufacturer’s instructions.

Belgian linen canvas (8.7 oz) was then prepared as an interleaf for the lining assembly. A stiffer, synthetic material with a bonded weave (such as polyester sailcloth or Sunbrella fabric) would have been preferable, but fabric wide enough to span the width of the mural was not available. The Belgian linen was stretched on a wood frame and then sized and stiffened with a mixture of equal parts Titebond wood glue and water. A coat of warm Beva 371b was then rolled onto one side of the Belgian linen and allowed to dry. The fabric was then positioned over the back of the mural adhesive side down and secured with heat from an iron applied through silicone-coated polyester film (Mylar). A layer of warm Beva 371b was then applied to the exposed side of the linen interleaf and allowed to dry. This surface would be bonded to the honeycomb panel.

The canvas mural, with the linen interleaf attached to it and still on its panel support structure, was then turned face up and placed onto a specially constructed worktable. The wood braces and support panels were removed to reveal the faced surface of the mural. The canvas facings were removed from the mural surface with combinations of mineral spirits and xylenes to dissolve the Golden MSA-based adhesive and Beva 371b, but the Kozo paper facings were left on the mural for the time being.

# <A-head> Adhesion to the New Rigid Support

Considerable thought was given to the approach and materials to be used for remounting the mural. From the outset it was decided to reattach the mural to a rigid support. This would respect the artist’s intent to marouflage and would provide continuous support for the heavy canvas. For this, an aluminum honeycomb panel was specially fabricated. In addition to providing the necessary rigidity, the conductivity of the aluminum would also facilitate the transfer of heat through its structure for lining at the recommended temperature of 65°C.

Given the size of the mural, the marouflage was to be carried out in four successive sections. A 122 x 244 cm temperature-controlled, silicone rubber heat sheet placed beneath the panel would deliver the required heat to each section ([**fig. 12.4**](file:///Users/RBarth/Desktop/Finalized%20files-Conserving-Canvas--72122-to%20prep%20for%20TR/12-Hodkinson%20Pocobene/fig-12-4)). Before heat was applied, trial runs were performed to ensure that enough vacuum pressure could be applied over the entire Dartek film envelope. This was achieved using two small vacuum pumps placed on either side of the panel, which were connected with plastic tubing to 1.25 cm polypropylene cord running along the outer edge of the panel. In the final trial, the mural and all the adhesion components were sealed with Dartek film, and the required suction successfully applied. Once we were confident that this method would work as intended, marouflage of the mural could proceed.

In preparation for lining, the worktable was covered with sheets of double reflective insulation (Reflectix) to reduce heat loss during the heating process. The temperature-controlled silicone rubber heat sheet was positioned for the adhesion of the first section at the bottom of the mural. Lastly, a coat of warm Beva 371b was applied to the face of the honeycomb panel, thus ensuring that the surfaces to be bonded were coated with a layer of the adhesive.

The mural was positioned onto the honeycomb panel, sealed with Dartek film, and then transferred onto the silicone rubber heat sheet. The vacuum pumps were attached with quick-release vacuum connectors, the heat sheet was turned on, and metalized reflective Mylar was placed over the section to retain heat. Once the paint surface temperature of all areas of the section reached 65°C, the heat was turned off and the bonded area allowed to cool down.

Everything appeared to have gone exactly as intended, but when the reflective Mylar was pulled back, a series of small bulges not present at the beginning of the heating process had developed along the center structural join of the panel ([**fig. 12.5**](file:///Users/RBarth/Desktop/Finalized%20files-Conserving-Canvas--72122-to%20prep%20for%20TR/12-Hodkinson%20Pocobene/fig-12-5)). The cause of the deformations was delamination of the aluminum skins. The same problem was also discovered on the reverse of the panel, raising questions about what had caused the panel failure and how to proceed. Would we continue with the process in the hope that the rest of the panel would remain intact, or should the procedure be abandoned? Because the panel was intended to support the mural over the long term, we could not in good conscience continue to adhere the mural to what was clearly a structurally compromised support.

The Boston Public Library was informed of this unfortunate setback, and in collaboration with the panel manufacturer we began to investigate the cause of the problem. At the same time, we started to formulate a strategy for the removal of the mural from the failed panel for remounting onto a new, structurally sound rigid support.

# <A-head> Reversal of the Failed Beva 371b Marouflage

The first order of business was to detach the 122 x 213.5 cm section of mural canvas now adhered to the failed panel. As the linen facing layer had been removed prior to the lining procedure, the section was refaced with linen to protect and support the paint layers. The fact that almost 2.8 square meters of the mural was adhered to the panel, while the rest was not, greatly complicated the approach to reversing the adhesion. Whereas solvents can be applied to the back of canvas-lined paintings to dissolve Beva 371b, in this case that would not be possible. The notion of delivering heat through the front of the mural to release it was rejected because of the excessive temperature needed penetrate the paint layers and melt the adhesive.

Some thought was given to the possibility of turning the mural on its face and dismantling the panel behind it down to the aluminum skin it was attached to, but that would be easier said than done. Attempting to then release the remaining adhered aluminum skin with heat from the reverse would have proven extremely difficult, as only a small area could be detached at a time. This approach was also rejected because of the difficulty of handling the aluminum skin and the considerable risk of damage to the brittle paint and ground layers.

The only feasible approach was to reheat the entire bonded portion of mural and then to roll the canvas off the panel when the Beva 371b adhesive reached its release temperature. Before any such attempt was made, however, small-scale replicas of the partially adhered mural were made, and from these tests, a suitable approach was devised. Affixing the bottom edge of the linen interleaf under the mural to the equivalent of a very large diameter Sonotube, and then slowly rolling back the mural when the release temperature was reached, was deemed the most sensible tactic: it would support the canvas, minimize distortion, and reduce stress to the paint layers.

It was empirically calculated that a tube with a diameter of 3.7 m would be required to accomplish the task. That being impractical, we decided to fabricate a section of such a tube large enough to cover the area of the adhered section. A form was fabricated by cutting 1.9 cm plywood into curved ribs attached to a frame ([**fig. 12.6**](file:///Users/RBarth/Desktop/Finalized%20files-Conserving-Canvas--72122-to%20prep%20for%20TR/12-Hodkinson%20Pocobene/fig-12-6)). Lauan board (0.64 cm thick), chosen for its pliable characteristics, was then attached to the ribs to create the outer, curved surface of the form, against which the mural would be supported during the adhesion reversal.

The curved plywood form was set over the mural and tied to 5 x 10 cm framing supports on either end with block-and-tackle pulleys. This arrangement would enable the operators at the four corners to slowly roll the curved form away from the bottom edge in a controlled manner, until the entire section was released. With the interleaf and linen facing tabs along the bottom of the mural secured to the bottom edge of the curved plywood form, the silicone heat sheet was turned on and the surface temperature of the aluminum honeycomb panel raised to 65°C.

As the Beva 371b began to release, the bottom edge of the curved panel form was slowly raised while the other end was lowered, enabling the mural to be gently pulled away from the honeycomb panel ([**fig. 12.7**](file:///Users/RBarth/Desktop/Finalized%20files-Conserving-Canvas--72122-to%20prep%20for%20TR/12-Hodkinson%20Pocobene/fig-12-7)). This went according to plan; however, cool air flowing between the surface of the panel and the underside of the linen interleaf caused stringing of the Beva 371b adhesive, a well-known occurrence in the hot-melt glue industry. As the strings cooled, the resulting hardening of the adhesive impeded the effort to pull the mural off the panel at an effective pace. Severing the strings with a metal spatula as they formed enabled the procedure to continue. The total time to reverse the lining, from the moment of lifting the curved form to complete detachment, took only four minutes. Critical to the success of the reversal process was the presence of the linen interleaf, which provided much needed support for the mural and took the brunt of the applied stress.

# <A-head> Honeycomb Panel Redesign

With the mural successfully detached from the honeycomb panel, the next step in the process was to determine why the panel had delaminated. The failed panel was fabricated with aluminum skins (0.8 mm) supported with poplar strips for the outer straight edges and medium-density fiberboard (Medex) edges cut to the shape of the arch. The width of the mural, which exceeded the width of available aluminum sheets, required a vertical seam in the center of the panel, which had been reinforced with 7.6 x 1.9 cm rectangular aluminum tube. The core of the panel was filled with aluminum honeycomb to provide rigidity and heat transfer. When the panel was commissioned, it was made clear to the manufacturer that the panel would be heated to 65°C–70°C and that an epoxy adhesive able to tolerate that temperature needed to be used in the fabrication of the panel.

After a review of the specifications and materials used to make the panel, it was determined that several factors led to its failure, including the type and amount of epoxy adhesive applied to the various surfaces and the choice of edge materials. In preparation for the fabrication of a stronger panel, the manufacturer produced numerous small mock-ups with various combinations of epoxies and edge materials. These were then heated to the lining temperature under vacuum and assessed for their structural integrity. Initially, many of these failed, but based on the results of the experiments two major changes were made to the construction of the panel. First, an epoxy adhesive that would tolerate temperatures of up to 80°C was obtained and successfully tested on mock-up panels. Second, the poplar and Medex edging materials were replaced with aluminum tube along the edges, which was also used for cross bracing. Additionally, the center vertical seam was reinforced with a 10 cm composite plate that spanned the inside of the seam; it was composed of 1.27 cm Hexcel aluminum honeycomb sandwiched between .125 cm 1/8 inch aluminum sheets. This composition greatly stiffened the structure, and the new panel was custom fabricated for the lining of the mural.

# <A-head> Modification of the Beva 371b Adhesive

The challenges encountered during reversal of the partially adhered portion of the mural led to a reconsideration of the properties of Beva 371b: namely, its high strength and the temperature needed to release it. Recently, Ploeger et al. considered the strength of Berger’s adhesive formulation and proposed the need for further research and development of adhesives with reduced strength and activation temperature ({{Ploeger, McGlinchey, and de la Rie 2015}}). As the entire Puvis de Chavannes marouflage may need to be reversed at some point in the future, thought was given to how conservators would go about doing this and what could be done during the present procedure to make that task less challenging. Once mounted onto its rigid support panel, the mural canvas would be in a relatively stress-free state, so such a high-strength adhesive would not be necessary. The question was how to go about reducing the strength and tack of Beva 371b while still providing sufficient adhesion. Additionally, lowering the activation temperature of the adhesive was deemed a desirable characteristic, especially for the brittle paint and ground layers.

As supplied by the manufacturer, paraffin wax makes up 9% of Beva 371b. It was deduced that the addition of a low-temperature paraffin wax to the stock solution would reduce not only the activation temperature of the adhesive but also the percentage of the other resins and tackifiers in the solution, thereby reducing the adhesive’s strength. Empirical tests were performed to determine if a modified adhesive with these desirable properties could be produced. Using Beva 371b dry resin mix, batches of the adhesive were weighed out and dissolved in solvents according to the manufacturer’s directions. They were then modified by adding 5% and 10% by weight of paraffin wax. A paraffin wax with a melting temperature of 50°C–54.4°C was chosen for testing. A control sample of unmodified Beva 371b was also prepared for comparison. Scrap samples of thick nineteenth-century decorative canvas, along with linen interleaf fabrics, were adhered to small honeycomb test panels. From the tests, it was determined that it was possible to sufficiently adhere the test samples at a much lower temperature of 54.4°C measured at the paint surface. The tests also indicated that at the interface between the aluminum panel and linen interleaf, the temperature remained below 60°C

To determine if the adhered samples could be released with less force, small, rigid cardboard tubes were attached to one edge of the test samples and the panels heated until the surface of the paint reached 54.4° C. Whereas it was not possible to roll back the unmodified Beva 371b at that temperature, the 5% and 10% samples both released from the aluminum panel, especially the latter, which could be rolled back using relatively little force ([**fig. 12.8**](file:///Users/RBarth/Desktop/Finalized%20files-Conserving-Canvas--72122-to%20prep%20for%20TR/12-Hodkinson%20Pocobene/fig-12-8)). Based on these empirical tests, it was decided to adhere the mural with a Beva 371b solution modified with the addition of 10% paraffin by weight. Because the lead-white adhesive on the reverse of the mural acted as a barrier, there was little concern that the modified adhesive would darken the canvas because of its increased flow.

# <A-head> Completion of the Marouflage Procedure

Assured that the new, redesigned honeycomb panel would tolerate the lining process, the mounting of the mural proceeded as originally conceived. A coat of the modified Beva 371b solution was applied to the surface of the new honeycomb panel and allowed to dry. The linen and Kozo paper facings were then removed from the mural surface. As previously described, the mural assembly was wrapped in its Dartek vacuum envelope. The first section of the mural was successfully adhered to the panel using the modified Beva 371b adhesive at a paint surface temperature of 54.4°C. Once cooled to room temperature, the panel was temporarily lifted onto foam blocks to reposition the silicone heat sheet under the next section of the mural (see [**fig. 12.4**](file:///Users/RBarth/Desktop/Finalized%20files-Conserving-Canvas--72122-to%20prep%20for%20TR/12-Hodkinson%20Pocobene/fig-12-4)). Section by section, the entire mural was successfully adhered using this system. The Belgian linen edges extending beyond the perimeter of the mural canvas were then wrapped around the edges and over the back of the honeycomb panel and adhered with Beva 371b using warm irons. Four heavy-duty metal right-angle brackets (two on each side) were mounted with epoxy and screws to the panel edges and back.

After selective filling and retouching, the mural was transported back to the staging for reinstallation. With just 3 mm of play on either side, the panel slid easily into its niche. The mural was positioned and checked for level, and the angle brackets were then screwed securely into corresponding wood blocking mounted in the niche recess (see [**fig. 12.1**](file:///Users/RBarth/Desktop/Finalized%20files-Conserving-Canvas--72122-to%20prep%20for%20TR/12-Hodkinson%20Pocobene/fig-12-1)).

# <A-head> Conclusions and Further Research

Although the reversal of Beva 371 adhesion from rigid support panels is a challenging process, the treatment undertaken on the *Philosophy* mural demonstrates that methods can be devised to carry out this type of procedure. While the mid-treatment setback caused by the failed panel was in the end successfully resolved, it raised questions about the present formulation of Beva 371b and its working properties. Research to date has explored certain properties of Beva 371, such as its stability and its potential use on other types of art. The process of reversing adhesion to rigid supports and the resulting effects on the canvas and paint layers, however, have not been thoroughly investigated.

The original formula Beva 371 was specifically developed for the lining and consolidation of paintings on canvas and has been used with apparent success for that purpose for over half a century. The revised formula, Beva 371b, continues to be an invaluable adhesive in the conservation field, but it has its own problems and limitations. Reevaluation of the adhesive, along with systematic testing, is much needed. The replacement of some of its components with new materials and resins could lead to the production of adhesives with properties tailored more appropriately to the job in hand, including adhesives of various strengths. Moreover, an adhesive with a lower activation temperature would be a welcome addition to the lining and consolidation materials at our disposal.

# <A-head> Acknowledgments

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# <A-head> Appendix

# <B-head> *Materials List*

Aluminum Honeycomb Panel, SmallCorp, https://www.smallcorp.com/

Belgian Linen (unprimed 8.7 oz.), Dick Blick Art Materials, https://www.dickblick.com/

Beva 371b (thermoplastic, elastomeric polymer mixture). Conservators Product’s Company, http://www.conservators-products.com/

Beva Gel, Conservator’s Products Company, http://www.conservators-products.com/

Dartek C-917 Film (nylon 6,6 film modified with a heat-stabilizing adhesive), TALAS, https://www.talasonline.com/

Golden MSA Matte Varnish with UVLS (isobutyl and n-butyl methacrylate resin solution with amorphous silica matting agent and hindered amine UV light absorber and stabilizer). Golden Artist Colors, https://www.goldenpaints.com/

Kozo Paper (Usu Mino, 15–16 g/m2) Hiromi Paper, https://hiromipaper.com/

Lauan Plywood, Lowes, https://www.lowes.com/

Metalized Reflective Mylar, Grabber Space Emergency Blanket, Recreational Equipment, Inc., https://www.rei.com/

Paraffin Wax, Reed Wax, https://reedwax.com/

Reflectix Double Reflective Insulation, Reflectix, Inc., https://www.reflectixinc.com/

Silicone-Coated Mylar, TALAS, https://www.talasonline.com/

Titebond Premium Wood Glue, Franklin International, http://www.franklininternational.com/Home.aspx